BIOWETMAN

- Wetlands management and conservation -

Impact of climate change on wetlands in Romania

Dan Bălteanu, Monica Dumitraşcu, Dana Micu

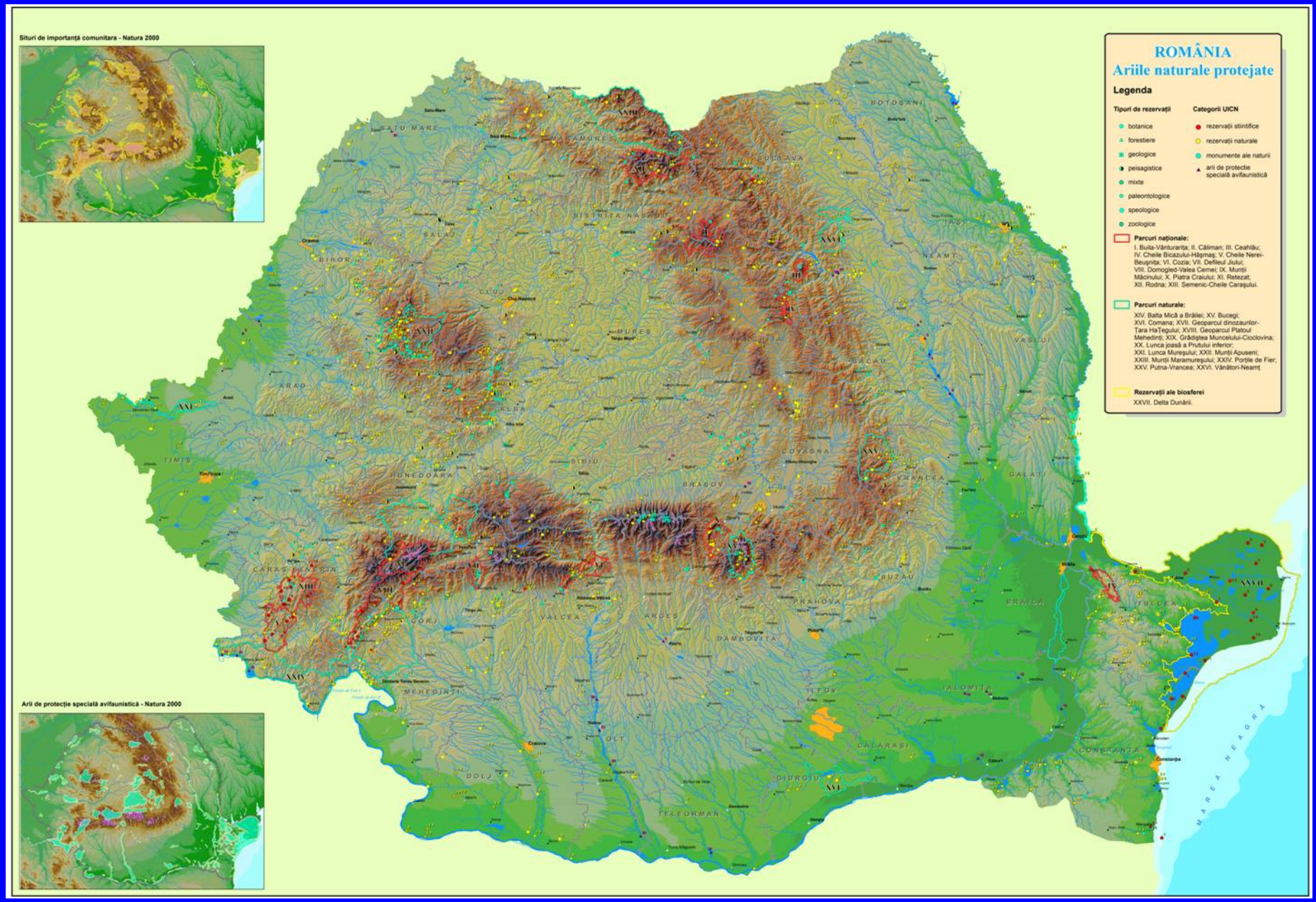
Institute of Geograpy, Romanian Academy

Bucharest - 2009

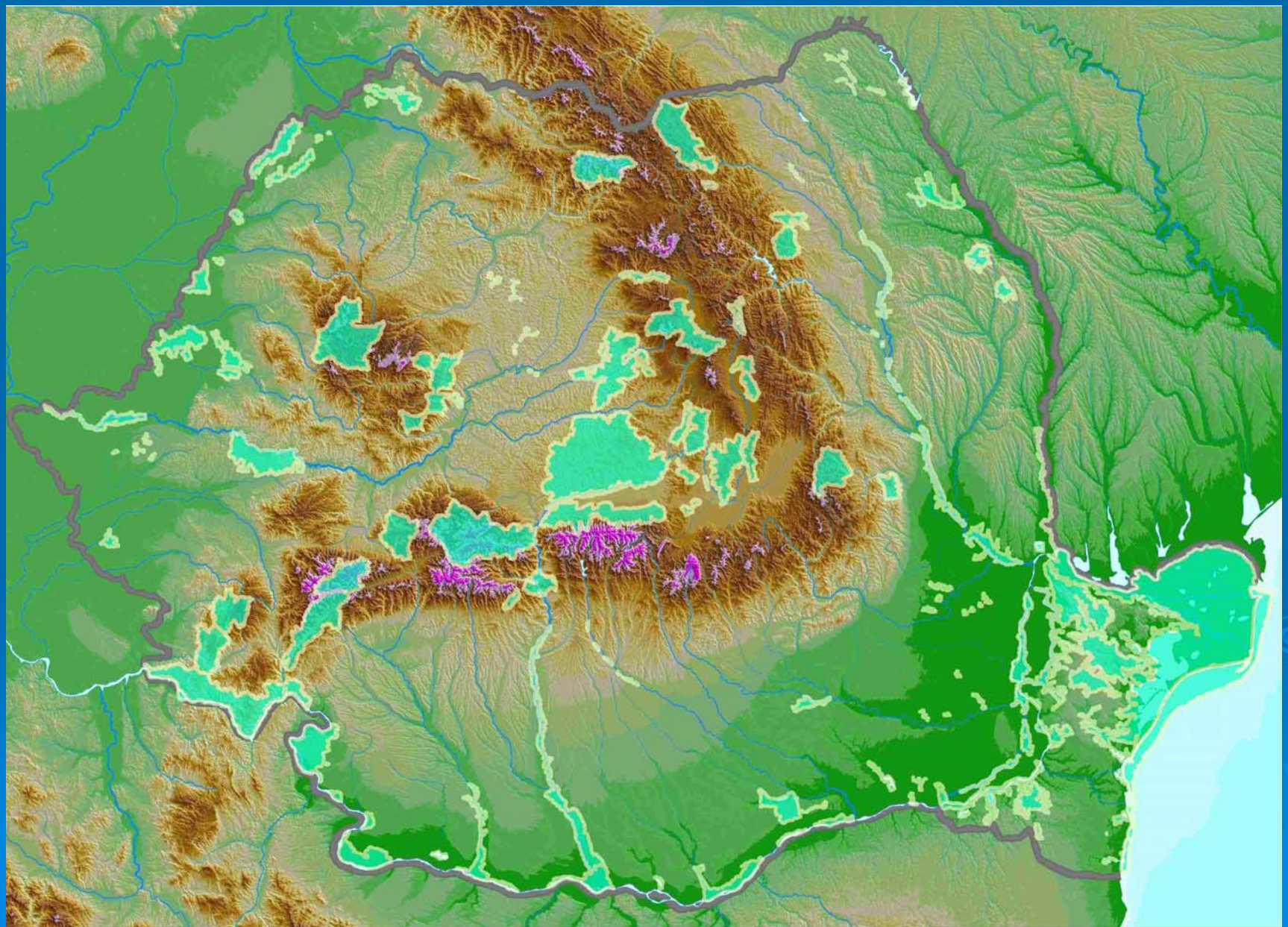
Natural protected areas

- Protected natural areas in Romania cover 1,798,782 hectares, that is, 7.55% of the national territory. Law No. 5/2000, the Government Decision 2,151 /2004, 812/2005 and 1,143/2007 provide:
  - 13 national parks (316 047,3 ha),
  - 14 natural parks (836 955,6 ha),
  - 3 biosphere reserves (665 444 ha),
  - 54 scientific reserves (100,224 ha),
  - 240 monuments of nature (2,213.3 ha),
  - 626 nature reserves (161 838,3 ha).
- In 2007 the national "Natura 2000" network was created, as a component of the European Ecological Network, including 273 *sites of community importance - SCI* (3,291,854.6 ha) and 108 *areas for special water fowl protection - SPA* (2,988,713.6 ha).

Wetland and Natural protected areas



Natura 2000 in Romania are including 108 *areas for special water fowl protection* (most of the wetlands).



Wetlands

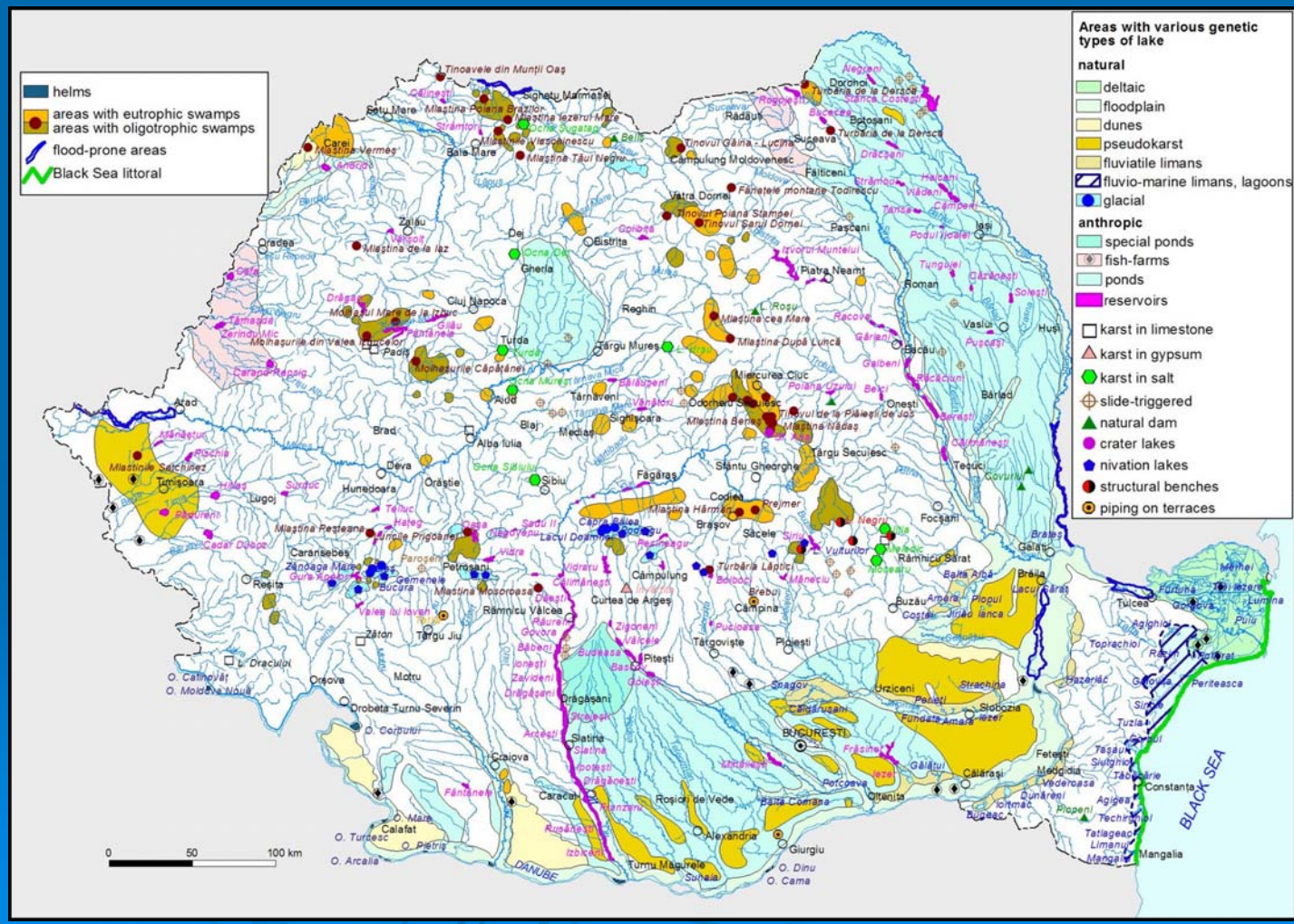
- In the *Convention on Wetlands of International Importance Especially as Water-Fowl Habitat,* Ramsar- Iran, 1978, to which Romania is a party since 1991, wetlands are defined as: *stretches of fresh-water, swamps, bogs, peat lands,permanent or seasonal, natural or artificial, stagnant or running, salmastrian or salty waters, inclusive of the bodies of shallow marine waters down to 6 m deep on ebb*.
- According to this definition, Romania possesses all types of wetland, obviously of different sizes.
- However, in the wake of embankments and draining to obtain more agricultural land, important wetland surfaces in the floodplains of inland rivers (the Siret, Prut, Ialomița, Argeş, Olt, Jiu, Timiş, Bega, Mureş, the Criş, and the Someş), and particularly in the Danube floodplain (cca. 560,000 ha), as well as several lakes, waters and eutrophic swamps with a diverse fish fauna and an important role in its reproduction were embanked and drained, the effects of which, even climatic ones, are fully felt in the south of Romania.

Wetlands in Romania

- Wetlands are about: **200** oligotrophic swamps (2,000 ha), **200** eutrophic swamps (5,000 ha), natural and man-made lakes (460,000 ha), river channels with permanent and temporary discharge (115,000 km) and some 400,000 hectares of Romanian seashore up to 6 m deep (*Gâştescu et al, 2005*).

Some of these wetlands are protected, others are being studied and recommended to be included in the world network of RAMSAR sites (5):

1. Danube Delta;
2. Balta Mică a Brăilei;
3. Dumbrăvița (BV);
4. Mureş Floodplain;
5. Techirghiol Lake (CT).



Vulnerability of wetlands

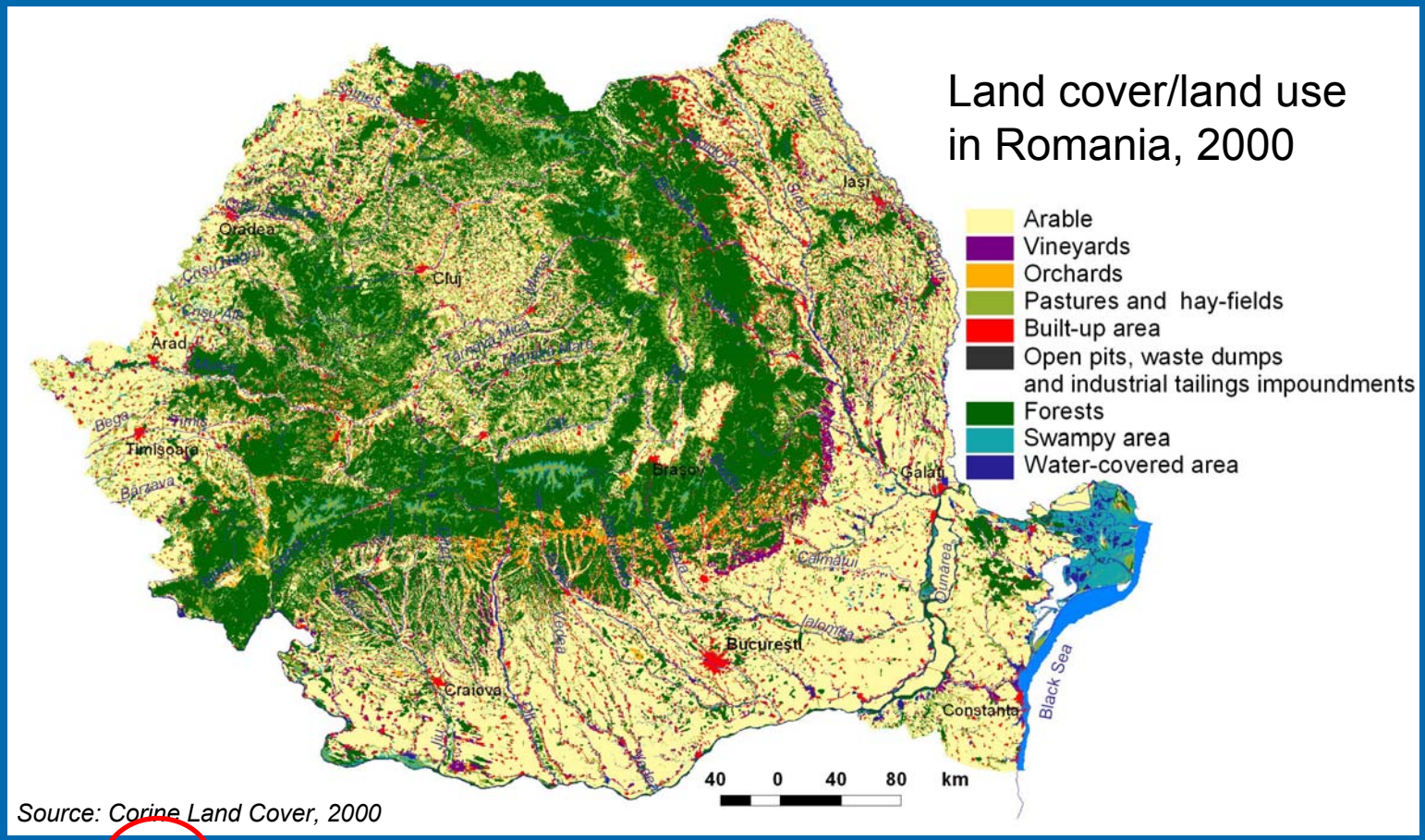
- High vulnerability of wetlands is determined by:
  - Ecosystems vulnerability towards anthropic activities and hazards;
  - Productive potential of these types of spaces determined by the presence of resources;
  - The necesities of agicultural spaces;
  - Attitude of population and local autorities which consider wetlands as unproductive areas;
  - Many pressures (e.g. **land use change**, pollution, extraction of water for urban or agricultural use);
  - **High frequency of climatic**, geomorphologic and hydrologic **hazards**;
  - Climate change has certainly already affected some wetlands and will continue to do so.

CHANGES IN LAND USE/LAND COVER

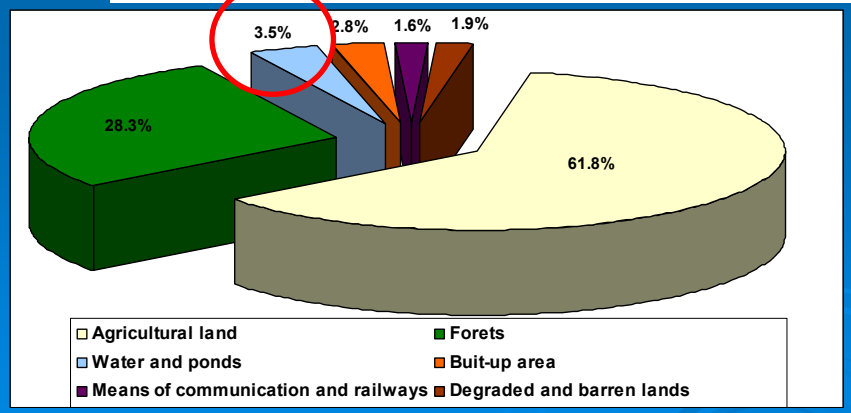
- Most visible during the transition period <= changes in property type of agricultural and forest lands and the dynamics of land cover/land use.
- Negative impacts on economy and environment:
  - Excessive fragmentation of agricultural land;
  - Very high proportion of subsistence individual farms;
  - Poor development of services in agriculture (mechanization, fertilization, irrigation, etc.)
  - Increase of land degradation and desertification.
- Main negative consequences on wetlands:
  - Decrease of wetland areas;
  - Habitats fragmentation and biodiversity loss.

Data sources:

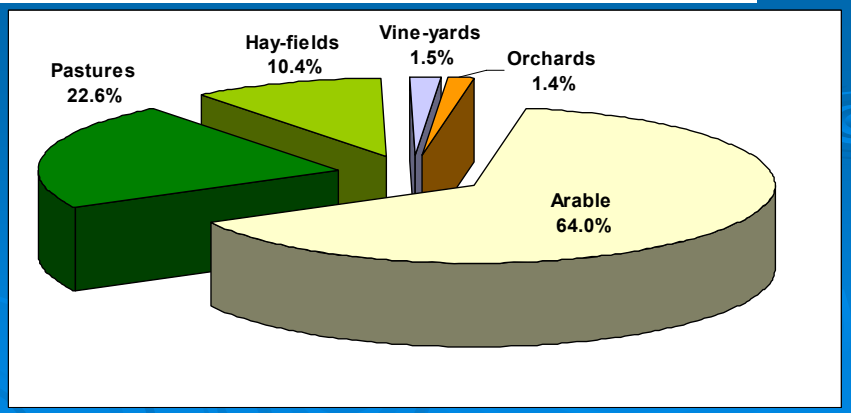
- Corine Land Cover (2000);
- Land Cover Classification System (2000);
- *Romanian Statistics Yearbook*, *Agricultural Farm Survey 2005*, *General Agricultural Censu 2002*;
- Field mapping and field survey.



Source: Corine Land Cover, 2000



Land cover/use in Romania, 2006



Structure of agricultural land, 2006

CHANGES IN THE TYPE OF PROPERTY

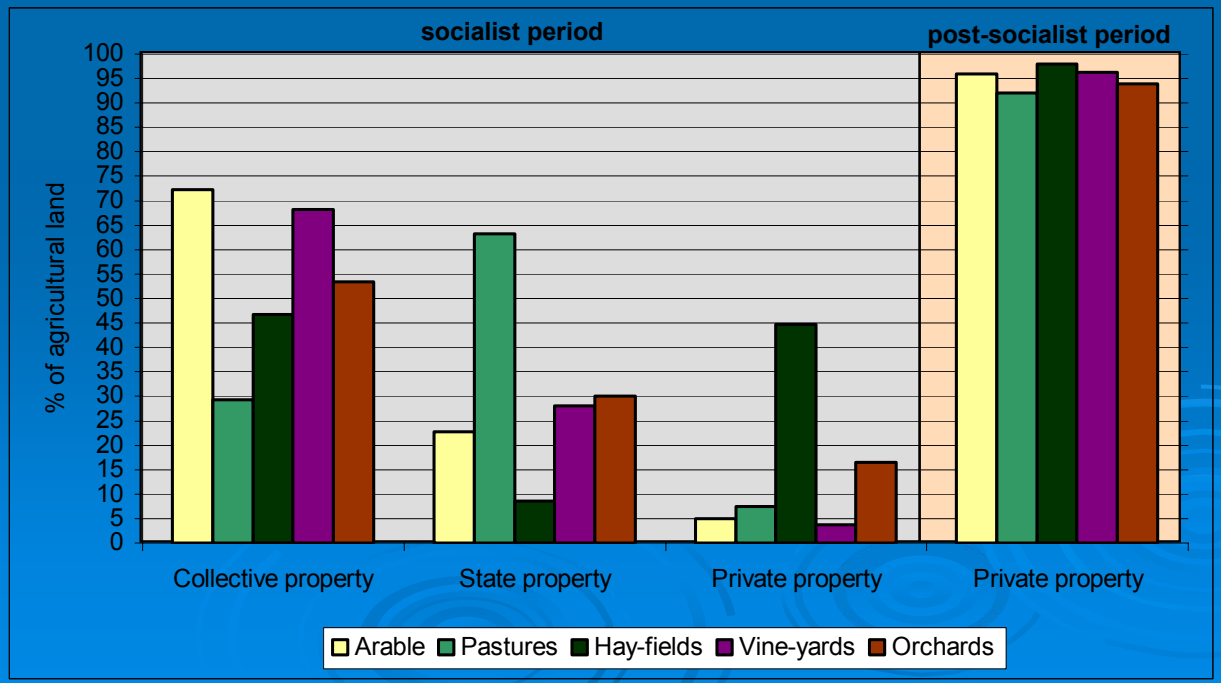
Socialist period

- Centralized state-controlled property and the existence of large farms;
- The collective property prevailed with all types of agricultural land use, the highest percentages going to vine-yards, orchards and pastures.

Post-socialist period

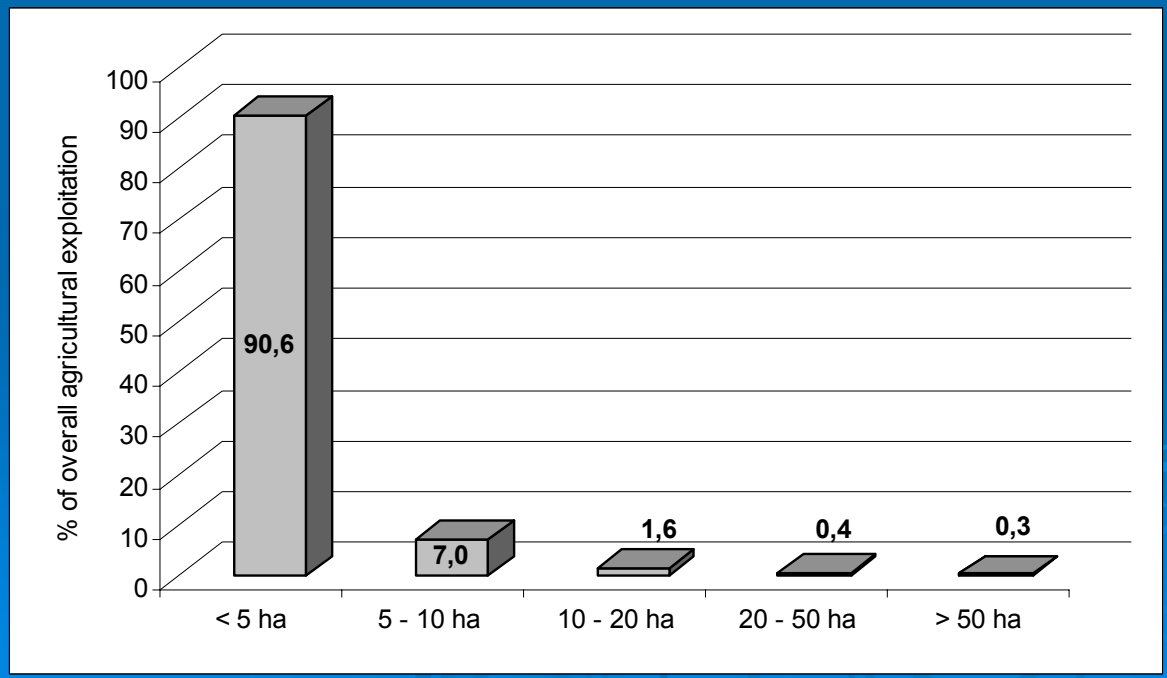
- Enlargement of private property up to 95.3% agricultural land and over 34.1% forest land (2006).

Land fund by categories of use and forms of property



CHANGES IN THE TYPE OF FARMS

- Out of the 4.25 million farms:
  - 99.5 % are individual farms
  - 0.5 have juristic person status (trading farms)
- Average agricultural area/individual farm: 2.1 ha, average number of parcels: 3.7.

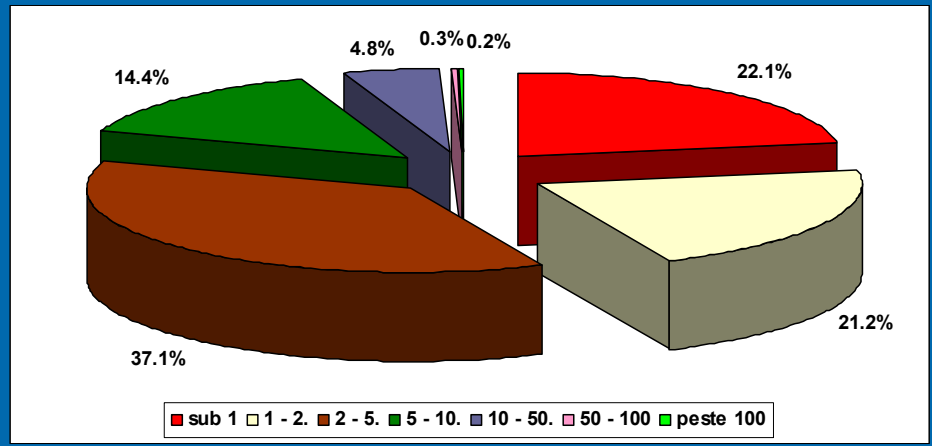


Farms by class size of agricultural area used (ha), in 2005.

FRAGMENTATION OF AGRICULTURAL LAND

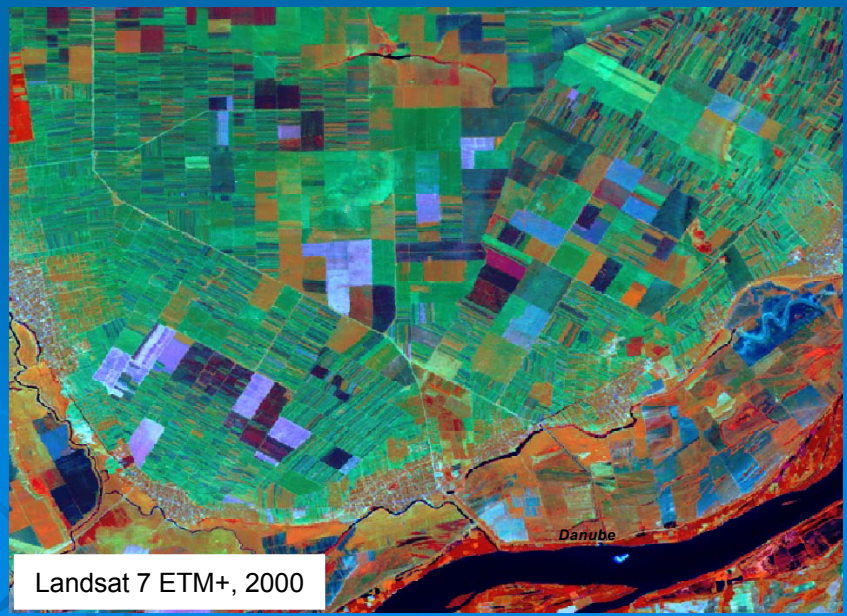
- 15.3 million estimated number of parcels in Romanian agriculture:
  - 41.1% have below 2 ha;
  - 51.5 % have 2 - 10 ha;
  - 5.3 % have more than 10 ha.

Agricultural area: size of parcels (ha), 2005



e.g. Romanian Plain

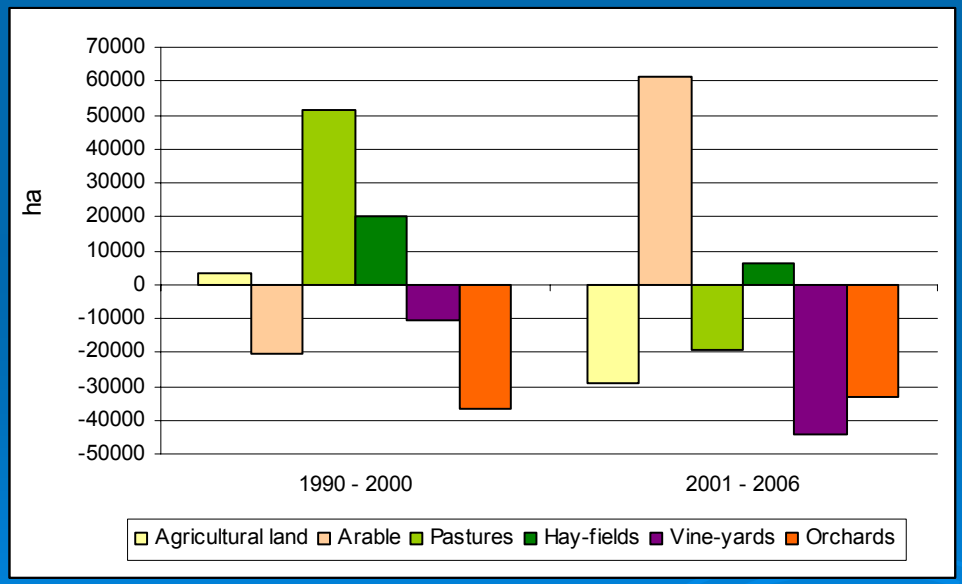
Landsat 5 TM, 1990



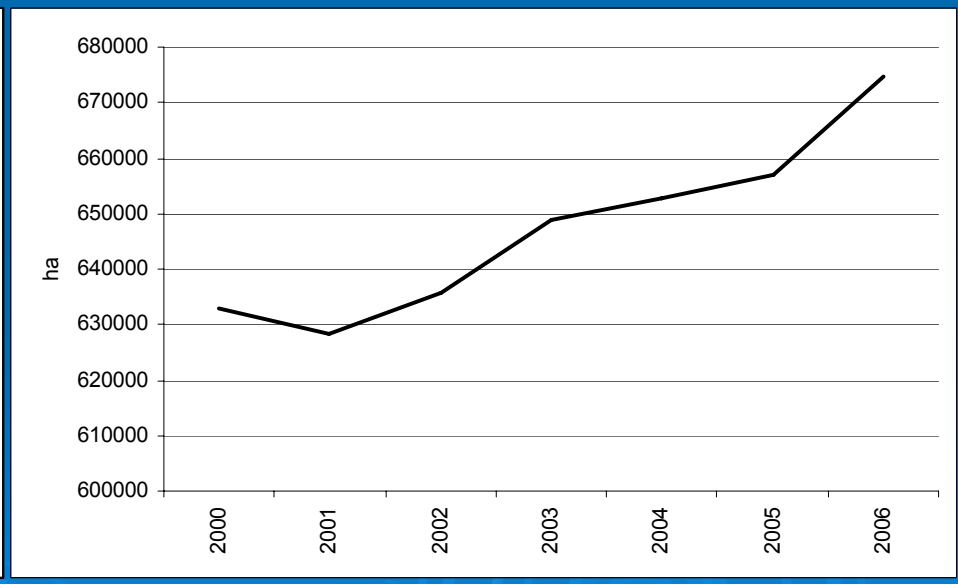
Landsat 7 ETM+, 2000

LAND USE DYNAMICS

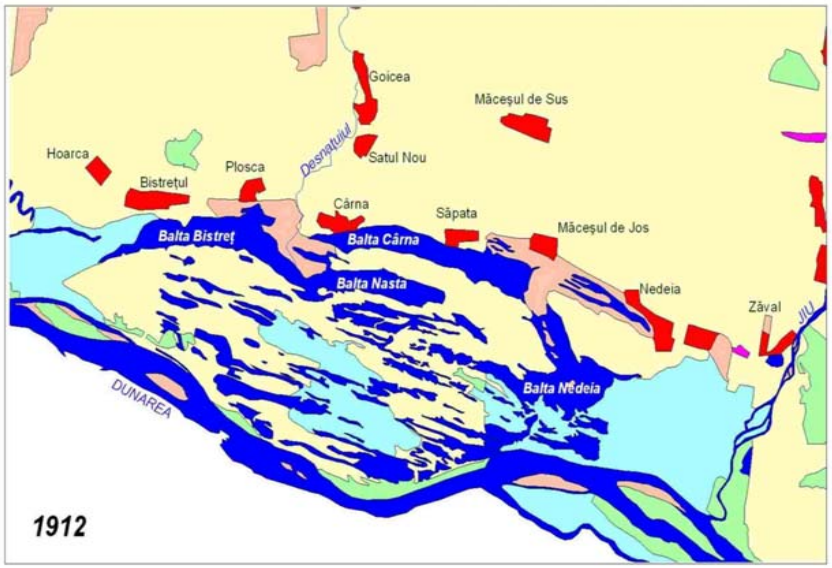
- The area of vine-yards and orchards shrank by 153.5 thou. ha;
- Pastures and natural hay-field areas extended to the detriment of arable land, vine-yards and orchards;
- After 2000, build-up and agriculture areas (threat for wetlands in the plain area) showed the highest increase.

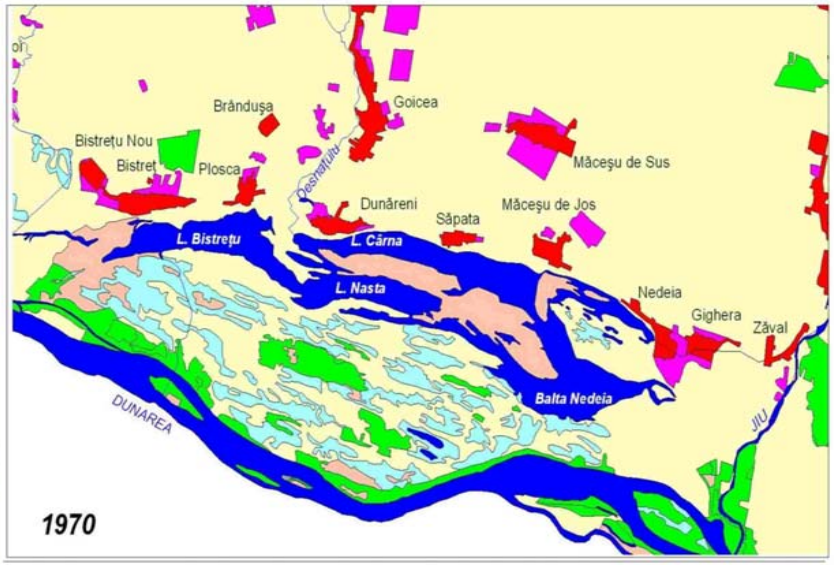


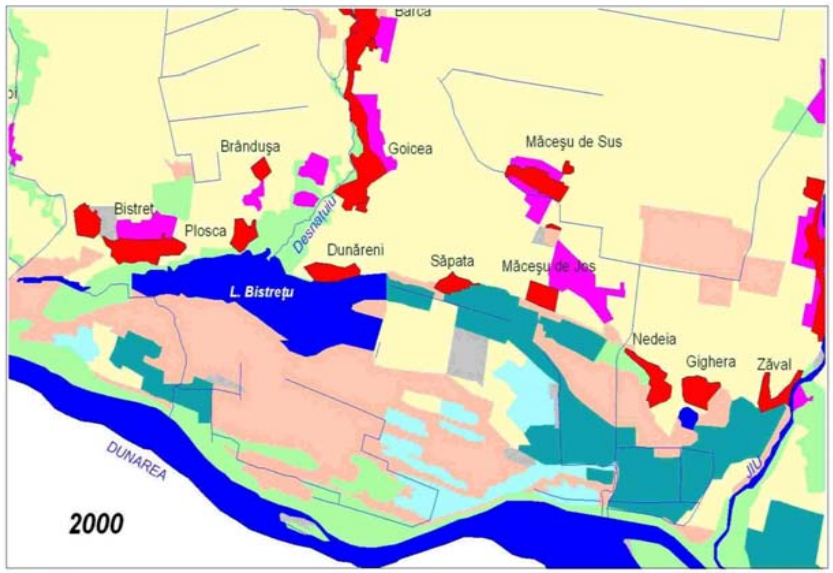
Land use dynamics

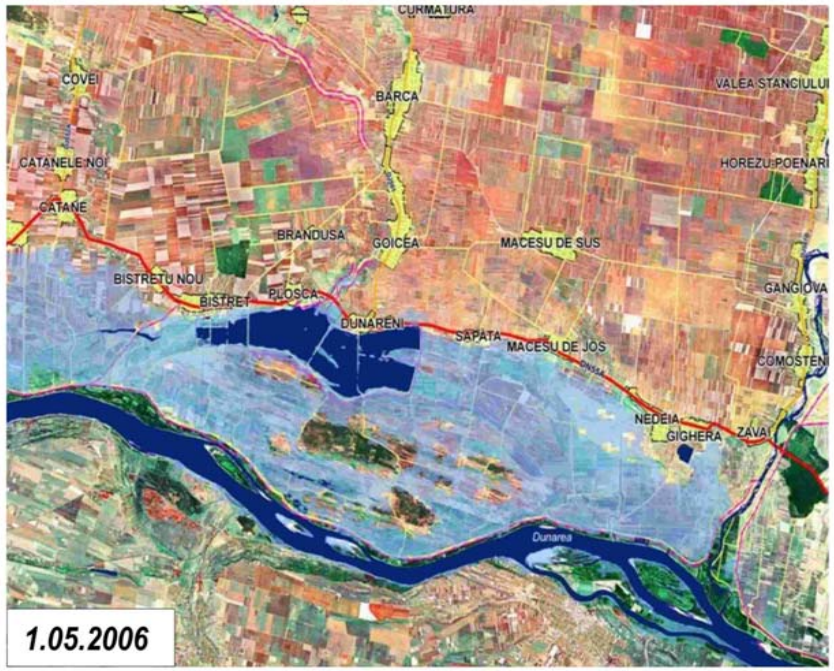


The evolution of built-up areas





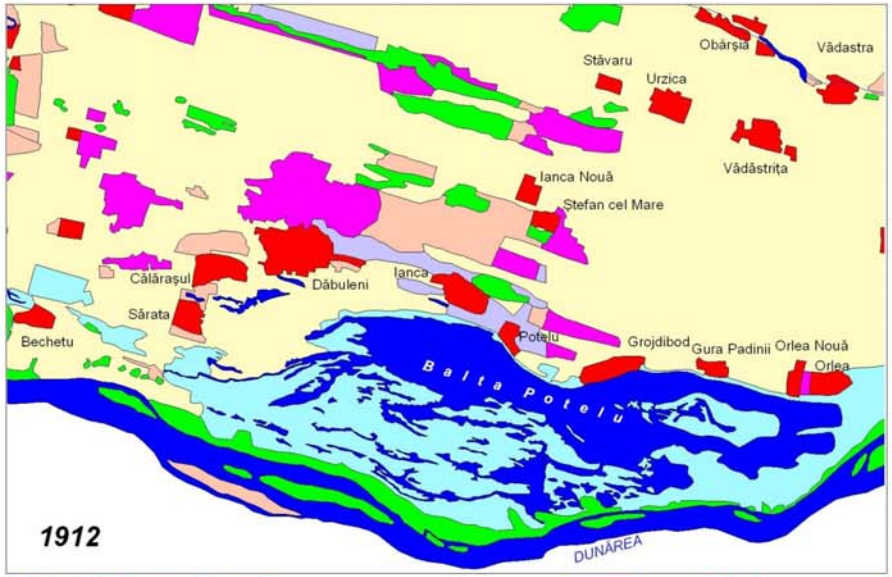


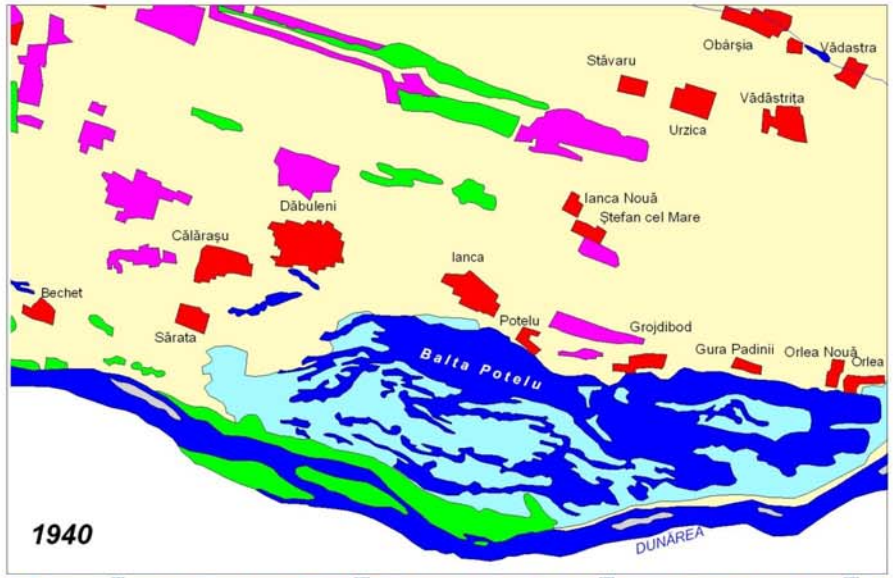


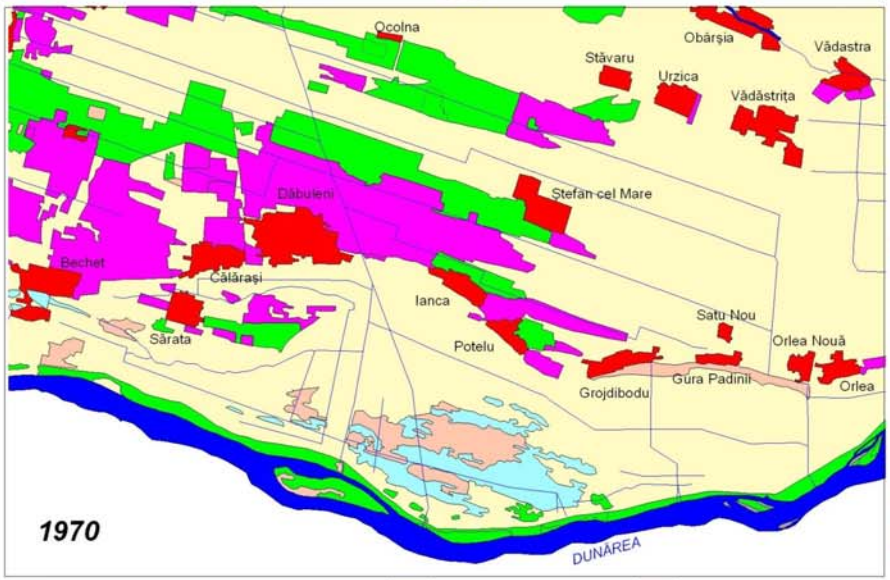
aşezări
suprafeţe acvatice
depresiuni mlăştinoase
teren arabil
vii şi livezi
păduri
păşuni şi fânețe
terenuri necultivate
incinte îndiguite

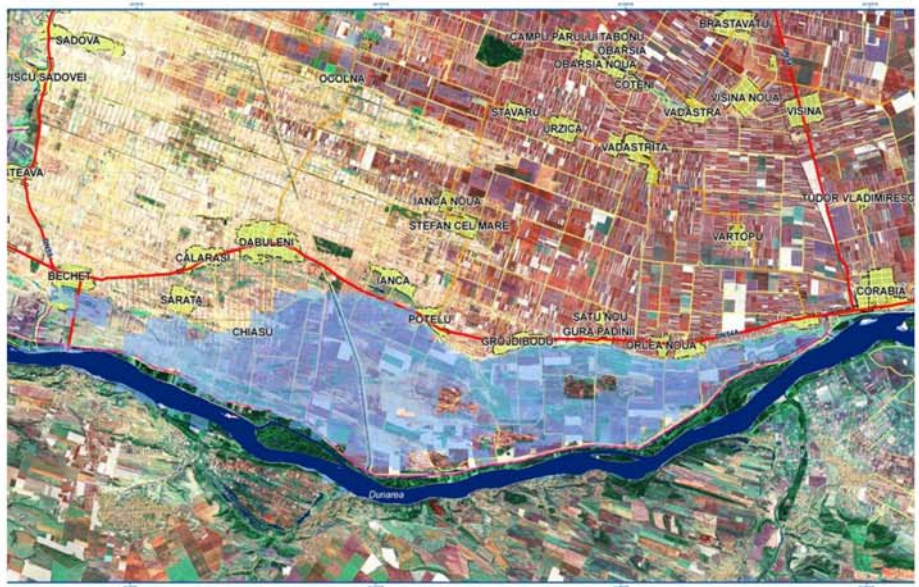
0 5 10 15 Km

Bistreț area, Danube Floodplain









aşezări
suprafeţe acvatice
depresiuni mlăştinoase
teren arabil
vii şi livezi
păduri
păşuni şi fânețe
pădure tânără, plantaţie
tufărişuri, mărăcinişuri

Potelu area, Danube Floodplain

LAND DEGRADATION AND DESERTIFICATION IN ROMANIA

- Anthropic factors (political, economic, technological etc.):
  - Marked fragmentation of agricultural land;
  - Very high proportion of individual farms;
  - Inadequate farming practices;
  - Few mechanized works;
  - Difficulties in implementing new production technologies;
  - Poor fertilization of crops;
  - Abandonment or destruction of irrigation systems and other land improvement systems;
  - Deforestation.


Abandoned irrigation channel, Sadova (May, 2002)

- Natural factors (extreme climatic phenomena: floods, droughts and landslides).


Zimnicea, August 30, 2003

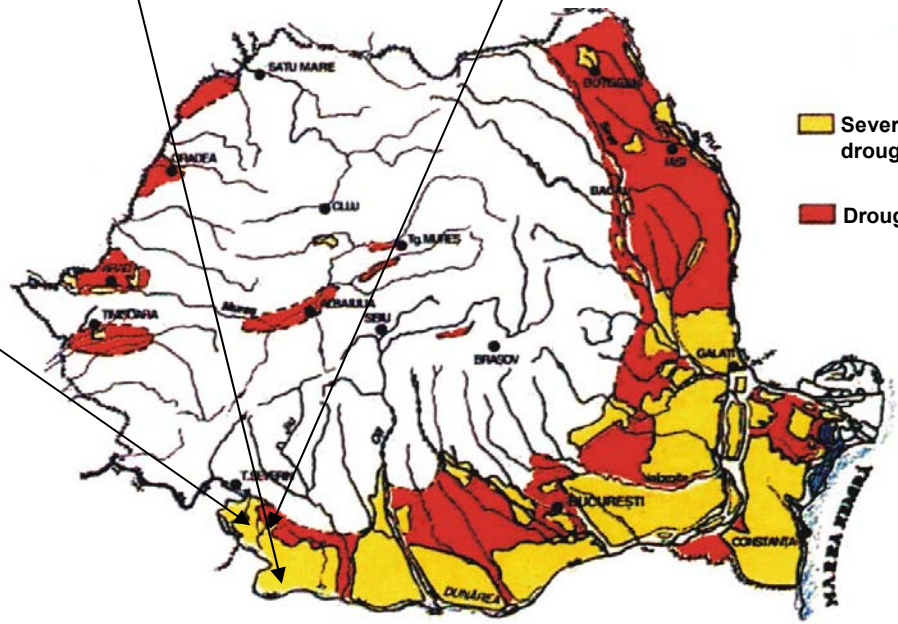

Zimnicea, August 30, 2003

Mobile sand dunes in Oltenia Plain, Ciuperceni (August, 1999)

Mobile sand dunes in Oltenia Plain, Danceu (May, 2002)

Robinia pseudacacia plantation affected by drought, Corlătel (August, 2002)

Drought-affected areas in Romania



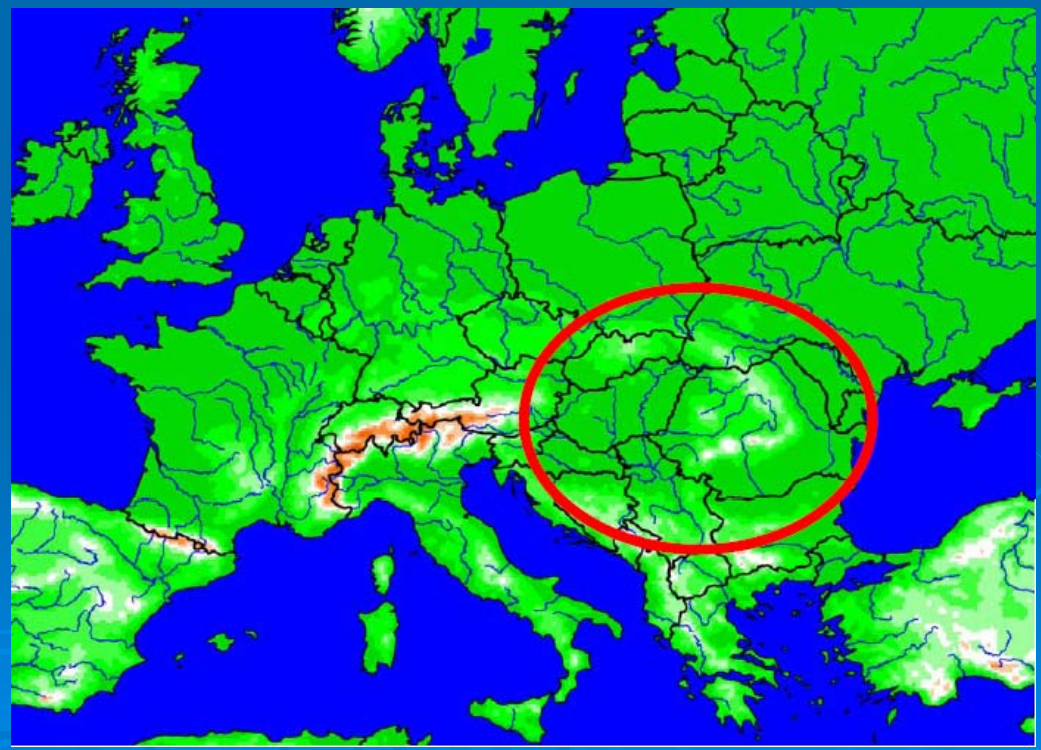
Source: Ministry of Waters and Environmental Protection, 2002.

CLAVIER – Climate Change and Variability: Impact on Central and Eastern Europe Specific targeted research project (STREP) in EU 6th Framework Program http://www.clavier-eu.org

Project duration: 2006-2009.
Focus countries: Hungary, Romania, Bulgaria.

Project Coordinator: Max-Planck Institute for Meteorology (Hamburg, Germany)

13 partners from 6 European countries:
Germany (1), Austria (2), France (1), Hungary (4). Romania(3), Bulgaria(2)

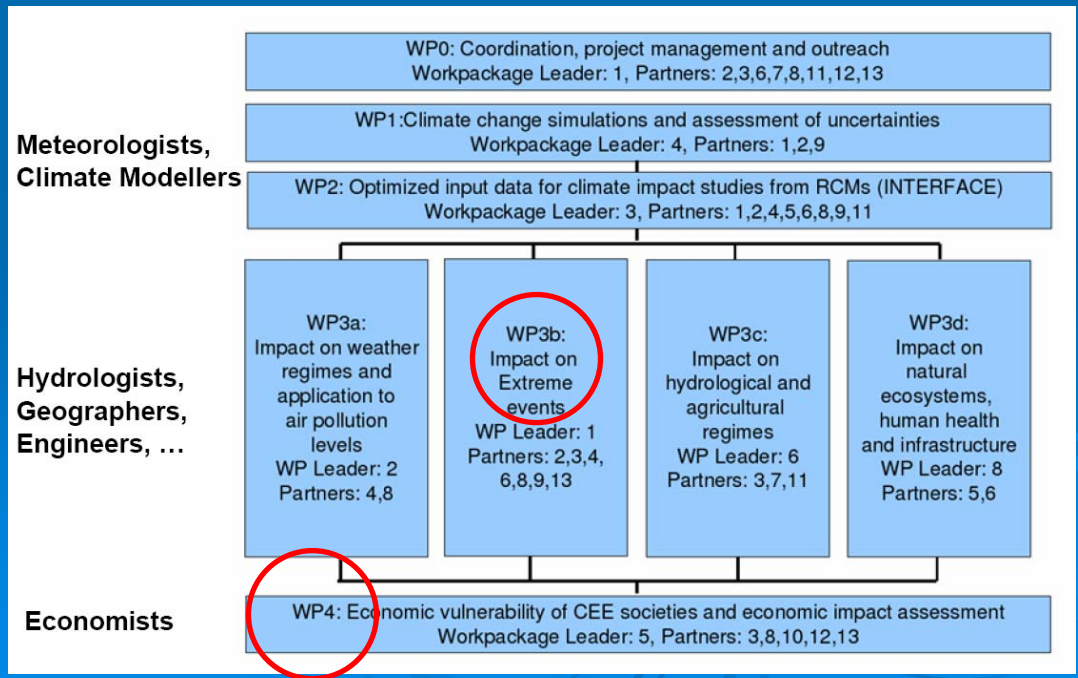


CLAVIER PROJECT OBJECTIVES AND STRUCTURE

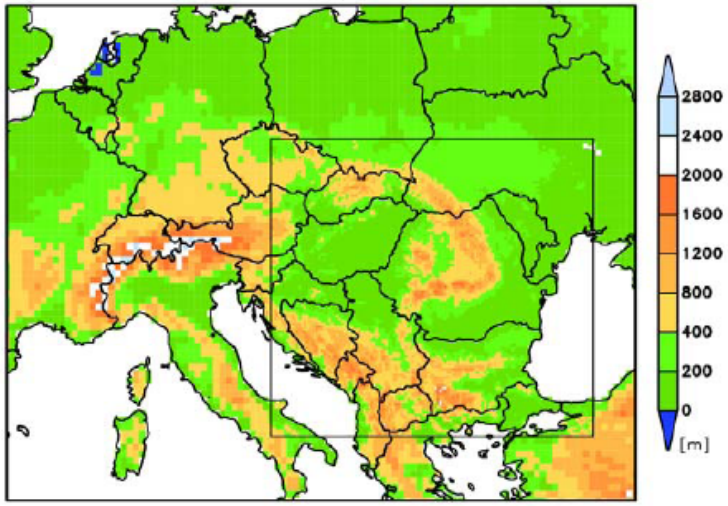
- Investigation of **ongoing and future climate changes** and their **associated uncertainties** in **Central and Eastern European Countries** (CEEC);

- Analyses of possible impact of climate changes in CEEC on **weather pattern** and **extremes**, **air pollution**, **human health**, **natural ecosystems**, **forestry**, **agriculture** and **infrastructure** as well as **water resources**;

- Evaluation of the **economic impacts** of climate changes on CEEC economies, concentrating on four economic sectors, which are agriculture, tourism, energy supply and the public sector.



CLAVIER CLIMATE SCENARIOS



REMO57 and REMO50 model domain (0.22° grid spacing) and high resolution domain (black box, 0.088° grid spacing). Source: MPI-M.

Simulation Period: 1951 – 2050

Em. Scenarios: A1B, B1

GCMs: ECHAM5, LMDZ v4

RCMs: REMO 5.7, REMO 5.0, LMDZ-regional, (MM5 for short-term, high resolution case st.)

RCM resolution: 25km, (10 km , 1km)

Statistical/geostatistical postprocessing

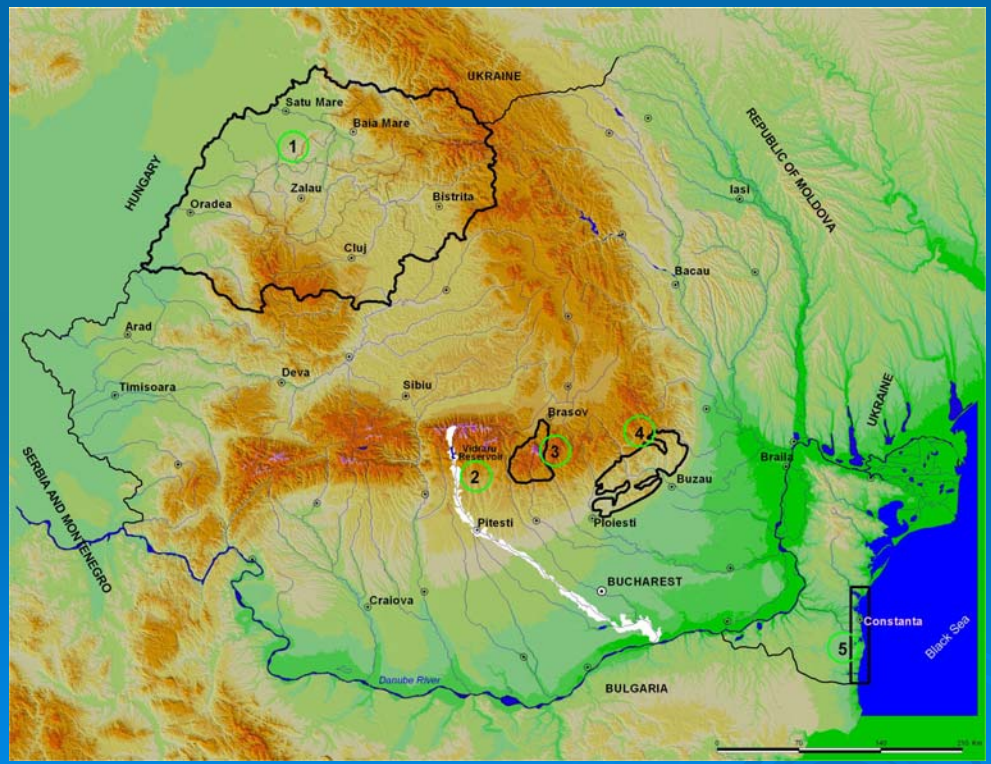
ID	*RCM*	*Period*	*Grid Spacing*	*LBCs*	*Emission Scenario*
Medium Resolution Simulations (Δx ~ 25 km)					
LMDZ-era40	LMDZ-regional	1961 - 2001	~ 30 km	ERA-40	Reanalysis of past climate
LMDZ-A1B-L	LMDZ-regional	1951 - 2050	~ 30 km	LMDZ version 4	A1B
LMDZ-B1-L	LMDZ-regional	1951 - 2050	~ 30 km	LMDZ version 4	B1
LMDZ-A1B-E	LMDZ-regional	1951 - 2050	~ 30 km	ECHAM5 (EH5_OM_20C_3, EH5_OM_A1B_3)	A1B
LMDZ-B1-E	LMDZ-regional	1951 - 2050	~ 30 km	ECHAM5 (EH5_OM_20C_3, EH5_OM_B1_3)	B1
REMO59-era40	REMO5.9	1961 - 2001	0.22 deg	ERA-40	Reanalysis of past climate
REMO59-A1B	REMO5.9	1951 - 2050	0.22 deg	ECHAM5 (EH5_OM_20C_3, EH5_OM_A1B_3)	A1B
REMO50-era40	REMO5.0	1961 - 2001	0.22 deg	ERA-40	Reanalysis of past climate
REMO50-A1B	REMO5.0	1951 - 2050	0.22 deg	ECHAM5 (EH5_OM_20C_3, EH5_OM_A1B_3)	A1B
High Resolution Simulations (Δx ~ 10 km)					
REMO59-era40-high	REMO5.9	1961 - 2001	0.088 deg	REMO59-era40	Reanalysis of past climate
REMO59-A1B-high	REMO5.9	1951 - 2050	0.088 deg	REMO59-A1B	A1B
REMO50-A1B-high	REMO5.0	1951 - 2050	0.1 deg	REMO50-A1B	A1B

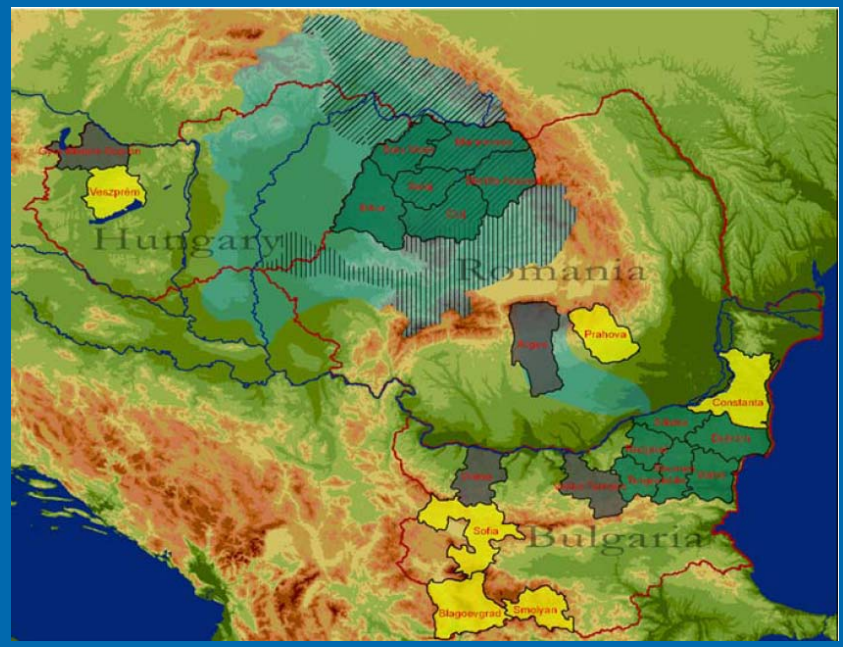
CLIMATE IMPACT CASE STUDIES

Light green: Hydrology. **Green:** Agriculture.

Gray: Energy. **Yellow:** Tourism

All Regions: Economic Impacts

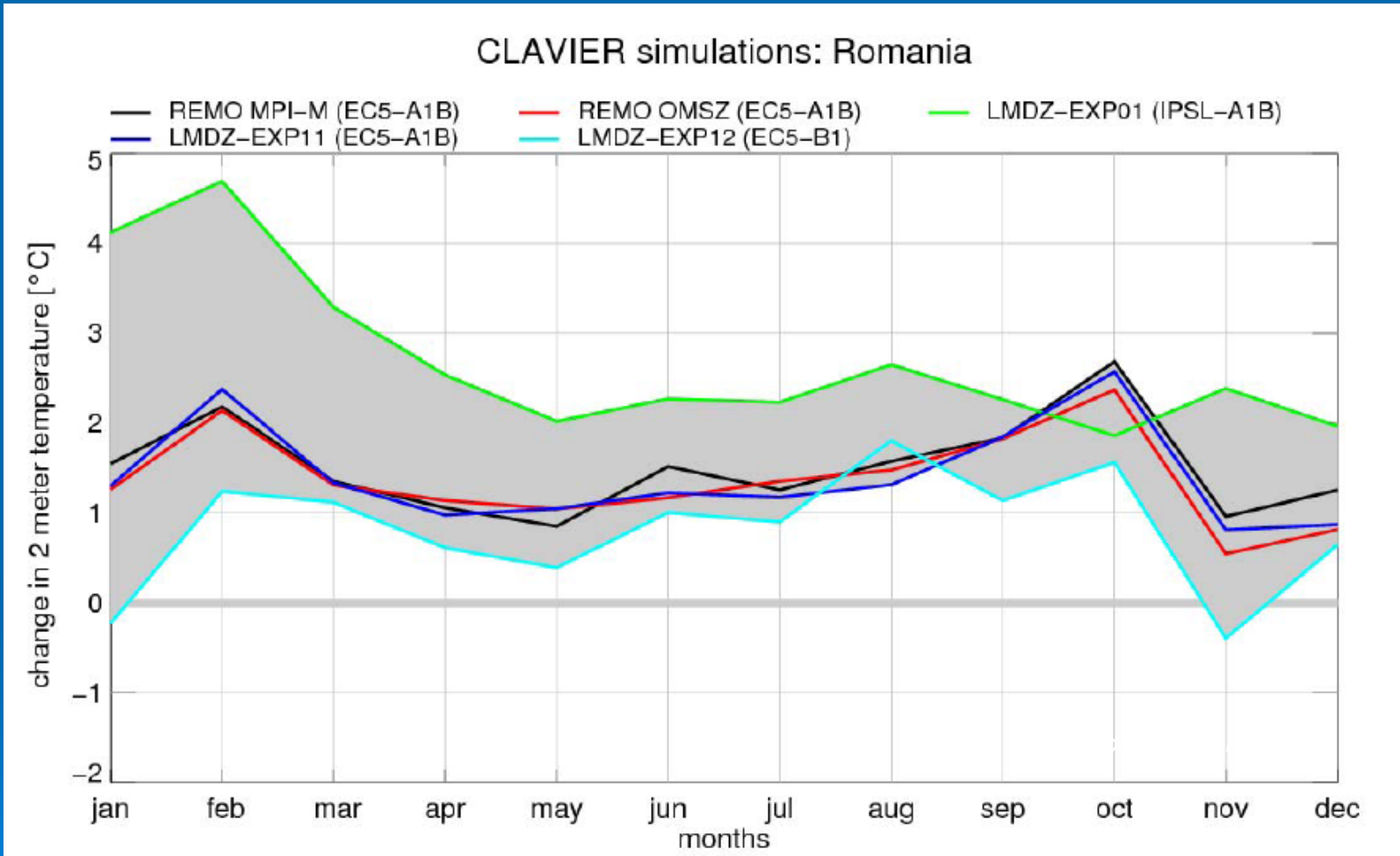




CLIMATE IMPACT CASE STUDIES IN ROMANIA

1. North-Western Development Region - Agriculture (WP4);
2. Vidraru Reservoir - Hydroenergy (WP4);
3. Prahova Valley-Poiana Braşov mountain area – Winter tourism (WP4);
4. Bend Subcarpathians – Extreme events (WP3b);
5. Southern Black-Sea littoral area – Summer tourism (WP4).

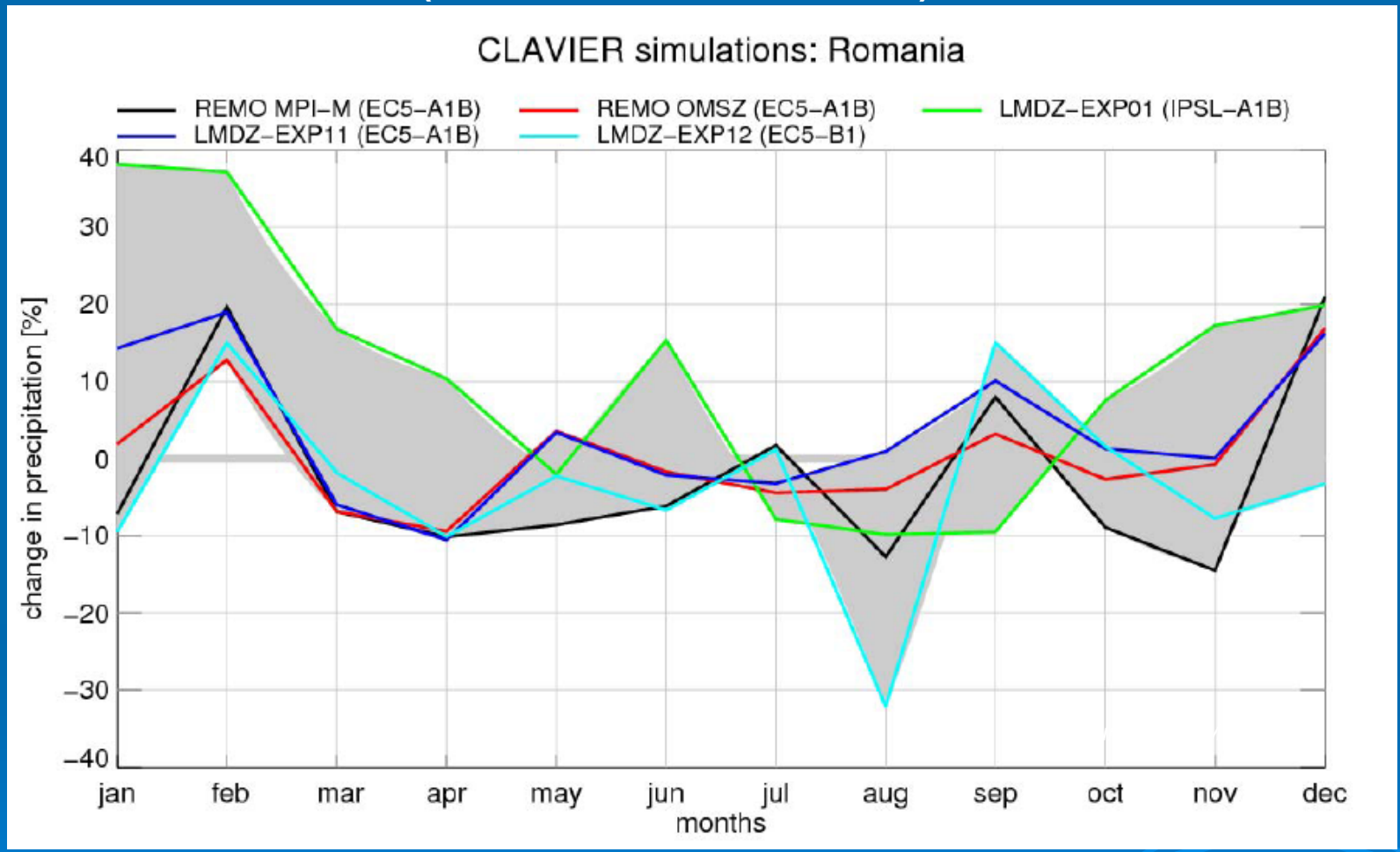
Climate change signal in Romania in mean monthly temperature (2021-2050 vs. 1961-1990)



- Estimated increase of annual mean temperature: ~ +2°C.
- Range of increasing rates: ~ +1°C to +4°C.
- General trend of climate warming: all seasons (less than +1°C).
- Transition toward milder winters: +2.8°C.

- Annual: 2025.
- Winter and spring: 2025.
- Summer: 2008.
- Autumn: 2011.

Climate change signal in Romania in precipitation (2021-2050 vs. 1961-1990)



- More precipitation in winter (~ 20%); range winter: -10% to +50%.
- No uniform signals in the other seasons (range from -30% to +20%);
- Summer: most likely precipitation decrease => severe droughts in the southern and south-eastern regions (negative deviations of at least 20%) + higher frequency of heavy rains;
- Uncertainty mainly due to GCM.

CONCLUSIONS

▪ *Wetland ecosystems are very fragile and vulnerable* to natural and anthropic pressures => long-term management activities, conservation policies within international and national cooperations and interdisciplinary studies;

▪ *Climate change is one out of the impact factors* that might derive threats for wetlands but able to induce the most disturbing consequences (on species and native ecosystems) ;

▪ Drivers of vegetation shifts: air temperature and precipitation.
▪ Temperature increase of 0.6ºC and general decreasing precipitation trends for most areas (significant seasonal and interdecade variability): in the last 100 years (Busuioc, 2008).

Expected impacts on the wetlands environment (species and native ecosystems):
• Increasing temperatures in some regions (very likely in the southern and south-eastern regions); seasons and daily patterns changing more than others;
• Changes in rainfall regime (*seasonal patterns, rainfall intensity, consecutive days with/without rain*) => less rain in some wetlands and/or more rain in others;
• Changes in the frequency, timing and severity of some extreme events (e.g. floods, droughts, convective storms and heat waves).

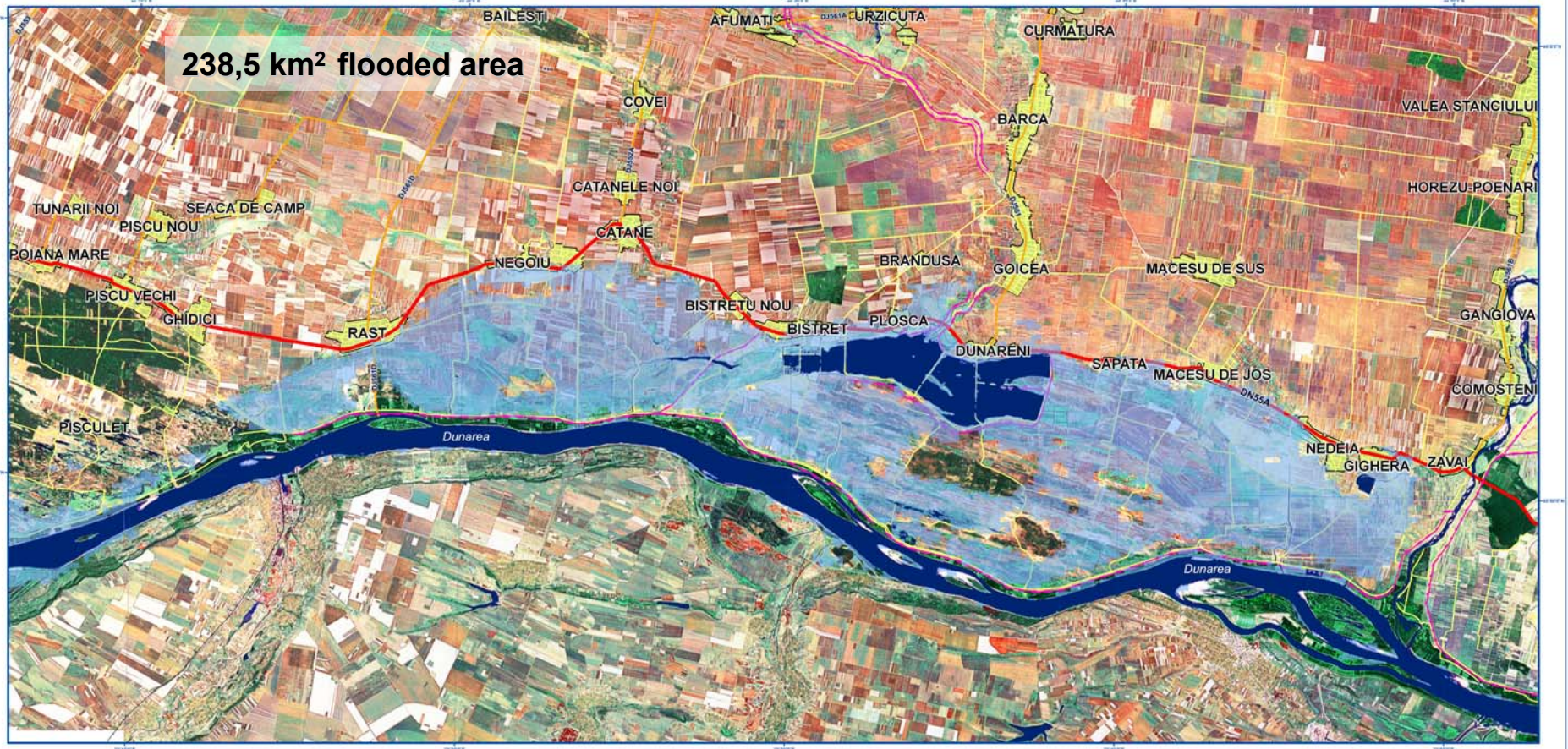
Likely impacts on populations of species of wetlands in Romania due to future temperature and precipitation trends:

• Changes in species abundance, with some species increasing in numbers and inhabiting new and larger areas, and others species decreasing;

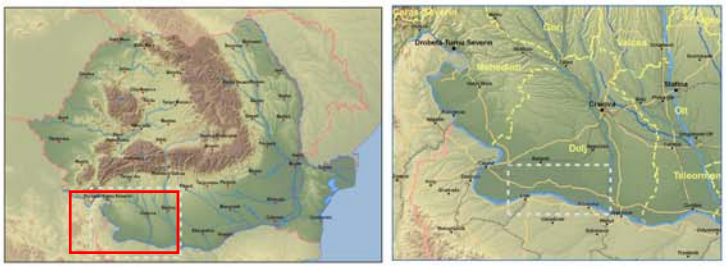
• Changes in the places species, with changes in temperature and rainfall patterns encouraging some species to move to new areas => unpredictable ways of carbon dioxide concentration changes, other interactions between species and the low availability of a suitable habitat;

• Changes in the genetics of species, which will occur as they evolve in response to the changing environment and changes in other species.

Zonele inundate din Lunca Dunarii: Sector Ghidici - Rast - Bistret - Macesu de Jos. 07.05.2006 ora 11:05



LOCALIZARE



LEGENDA

- Retea hidrografica (nivel de referinta)
- Zone inundate
- Diguri
- Drumuri europene sau nationale
- Drumuri judetene
- Drumuri comunale, de exploatare, strazi
- Cai ferate
- Localitati

0 1 2 4 6 8 Km

N W E S

EXPLICATII

Urmare a debitului istoric inregistrat pe Dunare in Aprilie 2006, digul ce proteja terenurile agricole din sudul judetului Dolj a cedat in data de 14.04.2006 pe teritoriul comunei Catane.

Suprafetele inundate au fost obtinute prin prelucrarea imaginii **MODIS/TERRA** din data de 07.05.2006 (rezolutie spatiala de 250 metri).

Imaginea de fond, mozaic **LANDSAT ETM+** (rezolutie spatiala de 15 metri), prezinta situatia zonei in anul 2000.

Sistem de proiectie Stereografic 1970.

ATENTIE: Acuratetea cu care au fost extrase zonele inundate este strins legata de rezolutia spatiala a datelor de intrare. Din aceasta cauza pot exista areale acoperite cu apa, ce au o suprafata mai mica de 250^2, care sa nu fie reprezentate.

CONTACT

Produs realizat de Administratia Nationala de Meteorologie. Laboratorul de Teledetectie si GIS.

Pentru mai multe detalii ne puteti contacta la adresa inundatii@meteo.inmh.ro sau la telefonul +40 21 318 32 40 - int. 163.

Romania
ANM
REMOTE SENSING & GIS LABORATORY
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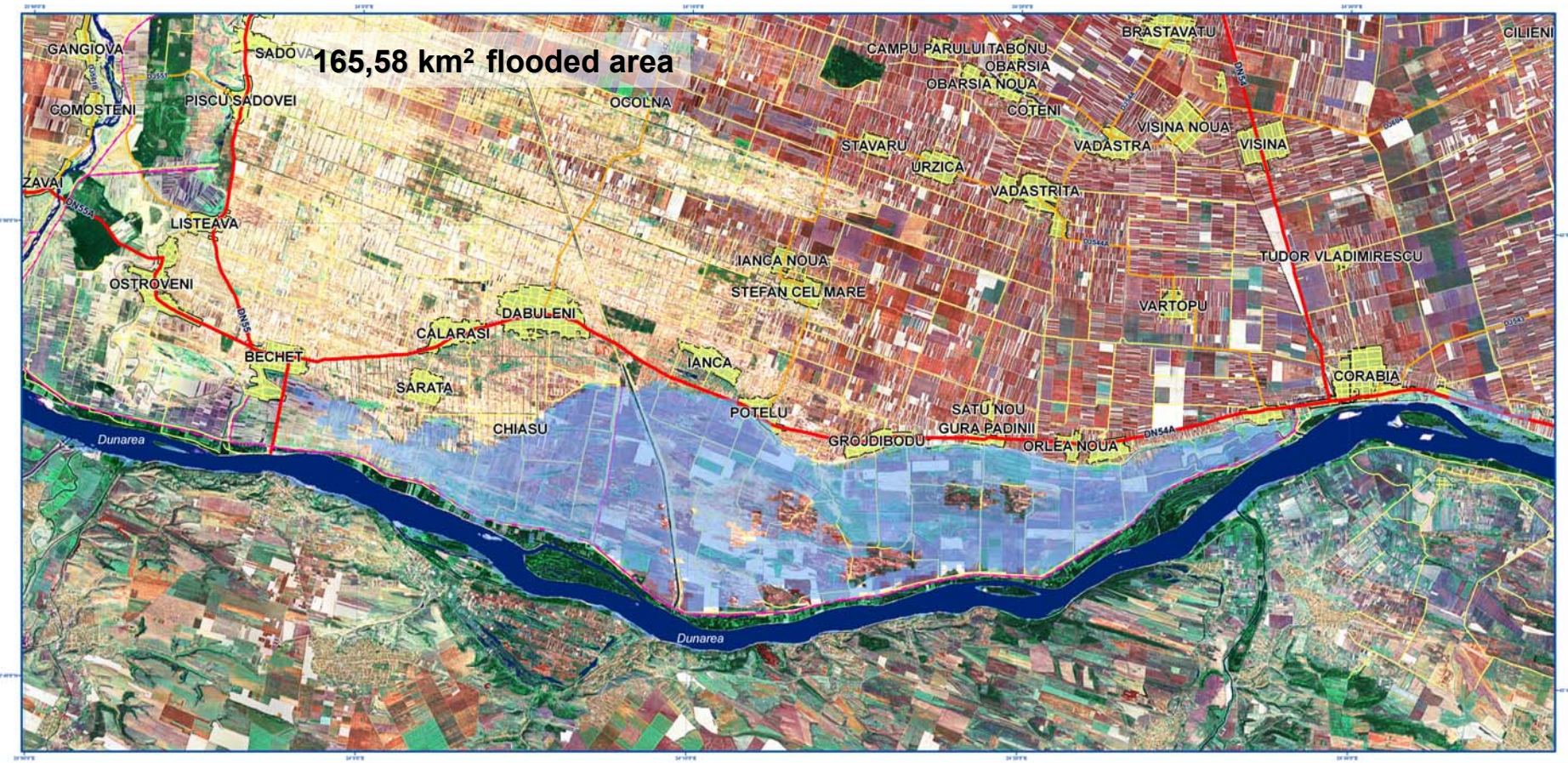
Proiect NATO SfP 978016
Monitoring of extreme flood events in Romania and Hungary using EO data.
http://nato.inmh.ro

Zonele inundate din Lunca Dunarii: Sector Bechet - Corabia. 07.05.2006 ora 11:05



LOCALIZARE

LEGENDA

- Retea hidrografica (nivel de referinta)
- Diguri
- Zone inundate
- Drumuri europene sau nationale
- Drumuri judetene
- Drumuri comunale, de exploatare, strazi
- Cai ferate
- Localitati

00.51 2 3 4 Km

N W E S

EXPLICATII

Urmare a debitului istoric inregistrat pe Dunare in Aprilie 2006, digul ce proteja terenurile agricole din sudul judetului Dolj a cedat in data de 23.04.2006 pe teritoriul localitatii Sarata.

Suprafetele inundate au fost obtinute prin prelucrarea imaginii **MODIS/TERRA** din data de 07.05.2006 (rezolutie spatiala de 250 metri).

Imaginea de fond, mozaic **LANDSAT ETM+** (rezolutie spatiala de 15 metri), prezinta situatia zonei in anul 2000.

Sistem de proiectie Stereografic 1970.

ATENTIE: Acuratetea cu care au fost extrase zonele inundate este strins legata de rezolutia spatiala a datelor de intrare. Din aceasta cauza pot exista areale acoperite cu apa, ce au o suprafata mai mica de 250^2, care sa nu fie reprezentate.

CONTACT

Produs realizat de Administratia Nationala de Meteorologie, Laboratorul de Teledetectie si GIS.

Pentru mai multe detalii ne puteti contacta la adresa inundatii@meteo.inmh.ro sau la telefonul +40 21 318 32 40 - int. 163.

Romania ANM

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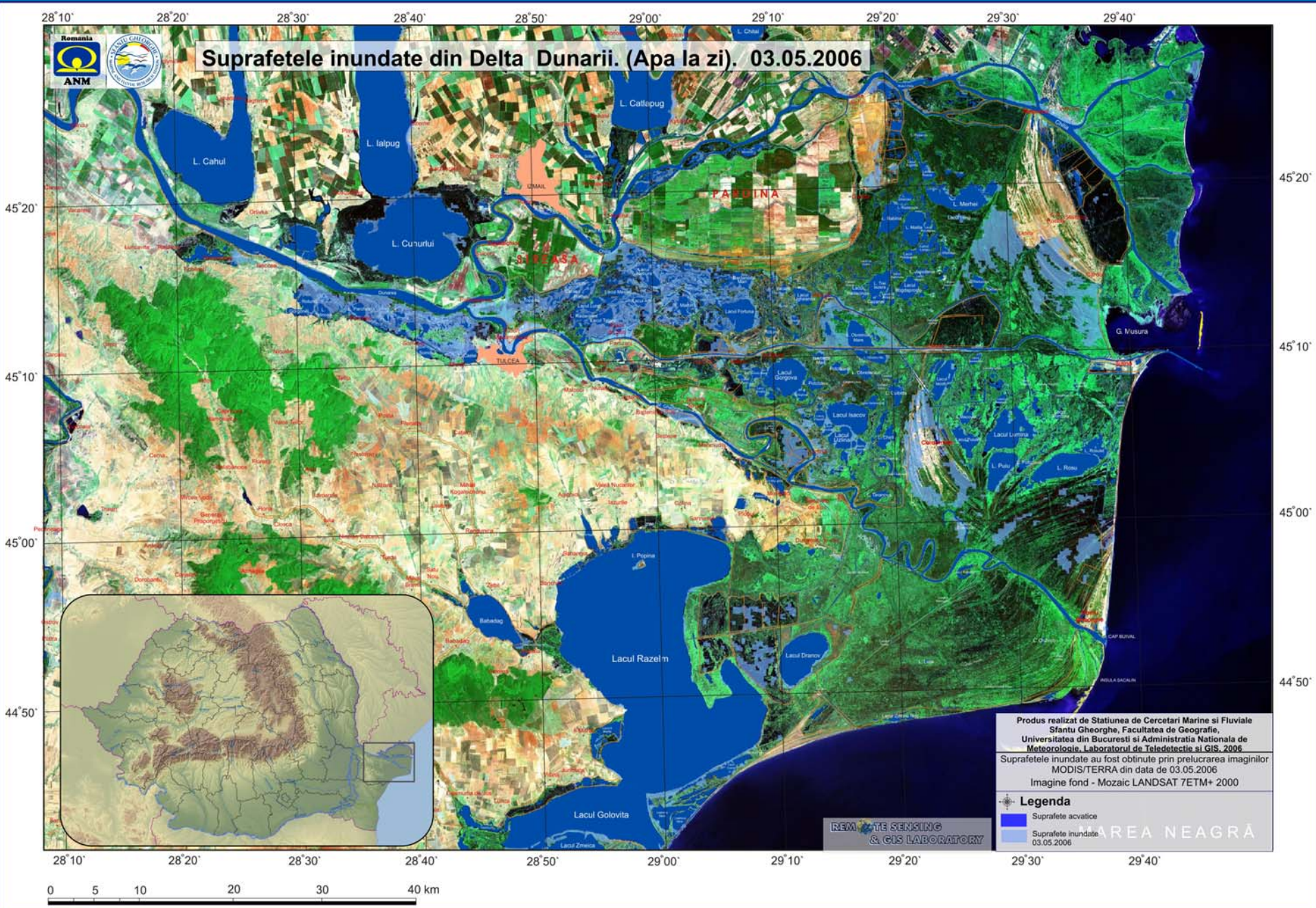

Suprafetele inundate din Delta Dunarii. (Apa la zi). 03.05.2006
Romania
ANM
28°10`
28°20`
28°30`
28°40`
28°50`
29°00`
29°10`
29°20`
29°30`
29°40`
45°20`
45°10`
45°00`
44°50`
L. Cahul
L. Ialpug
L. Catlapug
L. Cuhurlui
ISMAIL
PARDINA
SFISTOFA
TULCEA
G. Musura
Lacul Razelm
Lacul Golovita
Lacul Dranov
I. Popina
Produs realizat de Statiunea de Cercetari Marine si Fluviale Sfantu Gheorghe, Facultatea de Geografie, Universitatea din Bucuresti si Administratia Nationala de Meteorologie, Laboratorul de Teledetectie si GIS, 2006
Suprafetele inundate au fost obtinute prin prelucrarea imaginilor MODIS/TERRA din data de 03.05.2006
Imagine fond - Mozaic LANDSAT 7ETM+ 2000
Legenda
Suprafete acvatice
Suprafete inundate 03.05.2006
REMOTE SENSING & GIS LABORATORY
MAREA NEAGRĂ
0 5 10 20 30 40 km

Danube Floodplain ecosystem affected by the 2006 flood (Mănăstirea, May 2006)

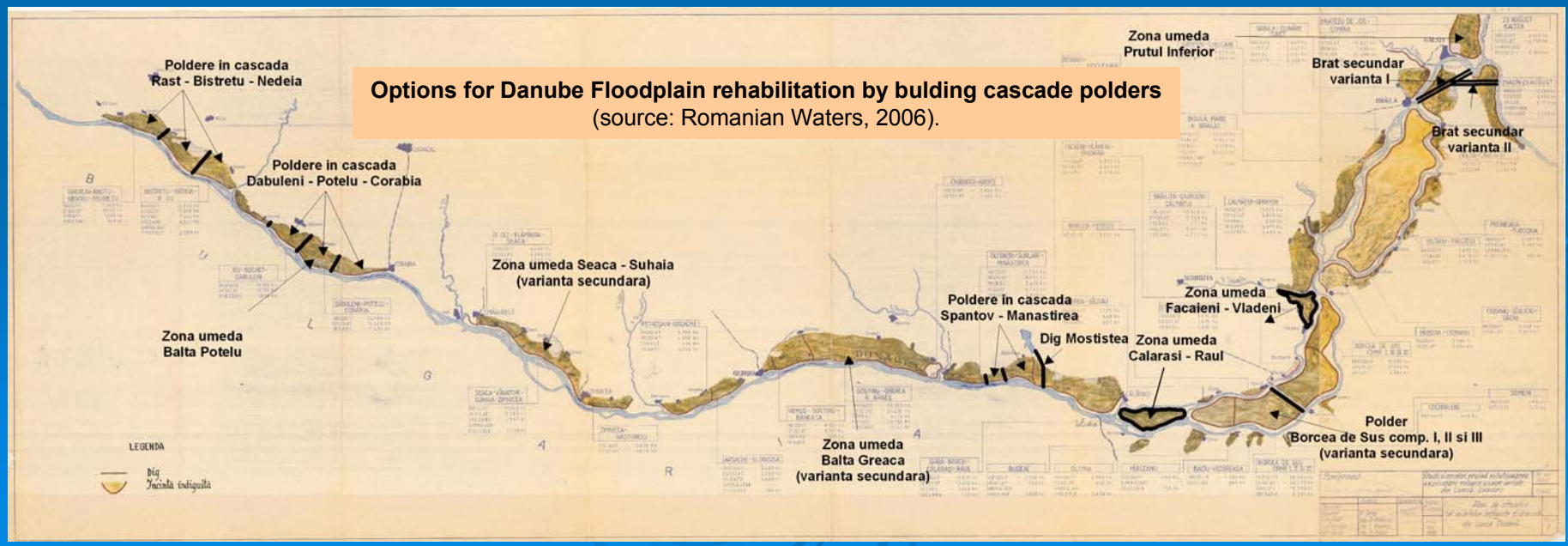
The alternative options for rehabilitation of Danube river after of the April-May 2006 flashflood are based on the new National Strategy for Flood Risk Management (HG 1854/22.12.2005) - containing the new European objectives for water management included in the European Directive concerning floods management:

I. Building of cascade polders in embanked areas already flooded:

- Rast-Bistreţu-Nedeia, Dăbuleni-Potelu-Corabia, Spanţov-Mănăstirea;
- Additional option: Borcea de Sus and the embanked area situated between the longitudinal dikes from the right side of Danube, in Brăila-Galaţi sector.

II. Creating of wetland habitats in order to preserve the biodiversity, especially in the areas artificially flooded: Călăraşi-Raul, Făcăieni-Vlădeni and Potelu (naturally flooded).

III. Building of secondary arms of Danube which will induce a water level decrease caused by the increase of discharge section.



Options for Danube Floodplain rehabilitation by bulding cascade polders
(source: Romanian Waters, 2006).

THANK YOU FOR YOUR ATTENTION !

INSTITUTE OF GEOGRAPHY, ROMANIAN ACADEMY
Dimitrie Racoviță Street, no. 12, sect. 2, 023993, Bucharest
Tel. +40 21 3135990, Fax. +40 21 3111242
Email. igar@geoinst.ro